

THE BENEFITS  
OF  
SANITARY REFORM,  
AS SHOWN AT  
SALISBURY,  
IN  
NINE YEARS' EXPERIENCE THEREOF.

A PAPER READ BEFORE THE BRITISH ASSOCIATION FOR THE ADVANCEMENT  
OF SCIENCE, AT BATH, SEPTEMBER 17TH, 1864.

BY  
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That we shall die, we know ; 'tis but the time,  
And drawing days out, that men stand upon.

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## PREFACE.

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PUBLIC HEALTH now forming a prominent topic of discussion, it is hoped that the following statements may be useful as showing the mode in which a city has been systematically operated upon by combined works of drainage and water supply; also its improved condition during nine years' experience. The Paper was read at the late meeting of the British Association, at Bath, and was written in compliance with a request received by me to describe the sanitary measures carried out at Salisbury under the Public Health Act, because "its great example cannot be too much known."

The subject of Sanitary Reform having been introduced at the British Association in more than one of its Sections, I trust that its vast importance will be there acknowledged, so as to lead to some practical suggestion therefrom—as to its methodical treatment throughout the whole kingdom. Having witnessed in the Section of Statistics the great interest taken in the metric system of weights and measures, as evinced by an animated discussion, which led to the formal recommendation of its adoption by Parliament, I cannot be too sanguine in hoping that the same learned and influential gentlemen who were so anxious about altering the measure of the "means whereby man lives" will, before long, be induced to feel at least an equal interest in the measure of "life" itself—the altering, by prolongation, of the vital metric system, being the main object of sanitary reformers. How vital statistics can be favourably influenced by physical agencies, it is believed that the following facts will form some means of judging; for although the experience at Salisbury has been upon a small scale, yet, as the population is strictly *urban* and but little changeable, the statistics gleaned therefrom over rather long periods of years are definite, and therefore valuable.

A. B. M.



## THE BENEFITS OF SANITARY REFORM, &c.

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HAVING been requested to furnish some account of improvements carried out at Salisbury, under the powers of the Public Health Act, I purpose—

1. To describe some local peculiarities, natural and artificial, of the site and city of Salisbury.

2. To make some remarks upon its past sanitary condition in ancient and in modern times.

3. To state the reasons why, and manner how, the Public Health Act was applied.

4. To describe the works done for drainage, sewerage, and water supply, with the cost thereof.

5. To describe the condition of the city since the works were completed—for the last *nine* years.

6. To conclude with a few general remarks.

1. *Local Peculiarities*.—Rather more than 600 years ago, the inhabitants of Old Sarum, for various reasons—a chief one being want of water—descended from the old dry Down by the river, or Sorbiodunum, into the valley, more than a mile to the south, and in a field, according to tradition, called the Merryfield, near to the conflux of three rivers—the Avon, Wiley, and Nadder—built their new cathedral and city. The present parliamentary city or borough of Salisbury, includes the large suburb of Fisherton Anger on the west side of the River Avon, in addition to the Close and city proper, with a portion of Milford. The Close, Fisherton, and Milford, are in the registration districts of the Alderbury Union. The city proper, consisting of three parishes, St. Edmund, St. Thomas, and St. Martin, is a registration district, with a population of rather above 9,000, and unless specified otherwise, the statistical and other remarks about to be made will refer to this district, the population of which is strictly *urban*, and but little changeable.

Surrounded by chalk hills, forming part of Salisbury Plain, the city of Salisbury is situated upon the east bank of the upper Wiltshire Avon, 140 feet above the level of the mouth of that river, where it joins the sea at Christchurch, about 30 miles distant. The city consists of about twenty streets, placed at nearly right angles; these streets covering about one-fifth of a square mile. This division of the ground into squares, called

chequers, was made at the time of planning the new city, and evidently was intended to have secured large yard lands or open spaces free from buildings—a wise object, which has been frustrated by numerous buildings for a long time past. The ground is pretty nearly level, having a very gradual incline of about 1 in 300, towards the south, except on the east side, where it rises sharply towards Milford Hill, the city extending a short distance up that hill, but to little altitude. At the south side of the city, separated by a wall, and until lately by a ditch, is the Close, belying one usual meaning of its name, inasmuch as it is a large *open* space, one-half of the size of the city, containing the cathedral in its centre, and about 80 houses. West of the Close, the Avon is joined by the Nadder and Wiley—considerable streams—and the three united having passed under Harnham Bridge to the south of the Close, flow eastward, and then turn somewhat to the north, so that Salisbury and the Close are inclosed within a loop formed by these rivers; a straight line from the Avon at the north end of the city to a point at the south-east corner thereof, being only 1,500 yards, whereas the course of the river around the city and Close is 2 miles. This quasi-peninsulated position was found most useful in the drainage operations. All the rivers are very rapid; there is no marshy ground in, or near to, the city, except about a mile to the northward, where some land by the river Avon is made swampy, owing to the existence of a mill-lead. This might readily be remedied, and sound meadows be made, merely by the introduction of a tube of iron under the river. The east of the city is bounded by Milford Hill, and the north by arable land gradually rising to a considerable altitude at Old Sarum and Bishop Down. The rivers are little liable to floods, a rise of even 3 or 4 feet above the ordinary level very rarely occurring, and much of that appears to be owing to obstruction presented by the old stone bridges with very wide buttresses. The ground upon which the city and cathedral were built, as before said, was called the Merryfield, which perhaps would indicate it as one used for sports, therefore naturally dry at the surface. Apart from this tradition, an examination of the locality will show that, before a mill-lead was made, the ground upon which the city stands must have been several feet higher than the natural level of the Avon: how the subsoil of the city became saturated with water, almost to the surface, will presently appear. The subsoil is a black mould, for a depth varying from a few inches to some feet, this resting upon a mixture of variously-coloured clays and sands, and these upon a bed of gravel; this gravel is firm, piles cannot be made to penetrate it, and it exists all across the valley at the same level, as made apparent by the depth at which it has been reached in making foundations for railway bridges and in building the main drains; this depth is about 9 feet from the average surface. Water per-



colates very rapidly through this gravel, and the subsoil itself is very porous, except in places where bunches of clay intervene. In making the drains it was found that these underground patches of clay formed basins, in many cases holding the water up within 2 or 3 feet from the surface.

A chief peculiarity of the city of Salisbury was, until lately, presented by certain canals or water courses, in nearly all the streets. As these water courses not only formed a strikingly peculiar feature of the city, but exercised a very detrimental influence upon the comfort, and, in my opinion, upon the health of the citizens, I will give some particulars about them, as to their state in ancient and in modern times. When it is remembered that one main cause of the migration from Old to New Sarum was the want of water in the old city, it is probable, though no documentary evidence exists to prove it, that the canals were cut through the streets for water supply; all of them were derived from the mill leat, except the new canal, which was taken from the mill tail. The Close ditch, derived from the Avon below the mill, was made with the wall for purposes of defence. The canals originally were in the middle of the streets, and evidently became used as cart roads; for in 1615 an order was made, the execution of which was to be enforced by penalty, viz., "that bars be set up "at the sides of the streets to keep down brewers' and other carts "in the rivers." There are occasional notices of these canals in old writers, which show that their original cleanliness had become neglected; but there is one particular notice in the council books which proves that the citizens were not altogether dead to the propriety of such cleanliness; indeed, they most probably had some idea of that truth which it has been found so difficult to impress upon their successors, namely, that dirty canals and disease were somehow intimately connected. This curious notice is in 1616, as follows:—"Forasmuch as the Pudding Bridge hath always been "repaired by the butchers of this city, and yet now the butchers "refuse to do the same; and whereas the butchers do now sell "their beasts' bellies to poor women and others, that pudding "wives do empty these bellies in the rivers in the streets, it is, "therefore ordered, that the butchers shall maintain the said "bridge or some other place, not noisome to the city, and wash at "that bridge, or at the great rivers, or some other back river, that "*runneth not into the open streets*, upon pain of forfeiture for "every offence 5 shillings."—Ledger C, folio 251). How strange that 240 years after this careful attempt to keep things *noisome* out of the canals in the open streets, the authorities of this same city should have advocated the continuance of open channels as sewers, into all of which the contents of very numerous water-closets were being passed. In reference to the influence of corrupt air upon the health of man, it may not be generally known that the

“wisdom of our ancestors” was greater than that of some moderns, and that the press of Caxton himself was employed in the cause of “sanitary reform.” In the third parliament of Henry the Seventh, the importance of the subject was fully recognised, as shown in an Act passed therein—which I am fortunate in being able to quote from one of Caxton’s own printed copies of the “Statutes:”—

¶ “Ayent Bochers.

“Item it was shewed by a peticyon put to the kyng our sayd soueryn lorde in the sayd parliament by his subgettes and paryshens of the parishe of Saynt Feythes and Saynt Gregories in London, nygh adioynaunt unto the cathedrall chirche of Powles, (that it was soo that grete concourse of peple as well of hys roiall persone, as of other grete lordes and astates, with other his true subgettes often tymes was had unto the sayd chathedrall chirche, and for the most parte through oute the parisshe aforesaid, the whiche often tymes ben gretly ennoyed and inuenemed by corrupt eires engendred in the sayd parisshe by occasion of bloode & other fowler thynges by occasion of the slaughter of bestes & scaldynge of swyne, had and done in the bocherie, of Seynt Nycholas flesshamels whos corrupeyon by violence) of unclene and putrified waters is borne downe through the sayd parishes and compasseth two partes of the palays where the kyng’s moost royale person is wount to abyde whan he cometh to y<sup>e</sup> cathedrall chirehe for any acte there to be doon to the Jubardouse abyding of his moost noble persone, and to ouer grete ennoisaunce of the parysshens there, and of other the kynges subgettes & straungers that pass by the same.” It goes on to say that “in few noble citees and townes or none wythin cristendome” is the slaughtering of “bestes wythin the walles” allowed, “least it myght engender sickness to the destruction of the peple.” And further to enact that penalties be imposed for slaughtering within the city “for every oxe 12 pens and every kowe and for every other best 8 pens.”

The canals of Salisbury seem always to have had great importance attached to them. Old Fuller thought them worthy of notice, as follows:—“As for Salisbury, the citizens thereof have derived the river into every street therein, so that the city is (like Venice) a heap of islets thrown together, according to the epitaph of Mr. Francis Hide, a native of this city, who dyed “secretary to the English Leger in Venice:—

“Born in the English Venice, thou didst dye,  
“Dear friend, in the Italian Salisbury.”

To any one acquainted with these canals in recent times, this comparison with Venice must appear silly, but when the couplet was written, it was a trifle less ludicrous, for the canals were a few yards wide, and in the centres of the streets, having, as before-said, been used as cartways. In an old map by Speed, dated 1610, this arrangement is clearly shown.

In recent times, as doubtless is remembered by most visitors to Salisbury, these canals were only about 1½ to 2 or 3 feet wide, lined with bricks, the water therein flowing nearly level with the streets, and about a foot or 18 inches deep; in heavy rains often overflowing into the streets. When this confining of the water-



courses to the sides of the streets and building them with bricks took place is not known, but it must have been after 1625, for in that year a petition was presented by the citizens to the Privy Council, when the king was at Wilton, stating that their streets and waterbanks were in a dilapidated and ruinous condition, that the inhabitants were for the most part poor, and unable to contribute towards their repair, praying for the consideration of the Council. An order was made by the Council to ascertain the owners of property, and to rate them proportionately. Their lordships undertook to refer such as refused to pay to His Majesty's Courts of Justice. This extraordinary proceeding proves in a singularly clear way that local self-government, so much boasted of in these days, was not of any practical utility at that time, at all events not in Salisbury.

2. *Past Sanitary State*.—Facts to be relied upon as to the actual sanitary condition of towns, as evinced by the death-rate, even in recent times, before the Registration Act, are very difficult to get; much more difficult is it, indeed it is impossible, to ascertain them of places in ancient times, therefore any statement as regards Salisbury can be at best but approximative, compared with the accurate figures obtainable from the Registrar-General since 1837. In that wonderful book, the “Anatomy of Melancholy,” there is an allusion to Salisbury worth quoting. Burton there writes, “The worst is a thick, cloudy, misty, foggy air, such as “comes from fens, moorish grounds, lakes, muck-hills, draughts, “sinks, where any carcases or carrion lies, or from whence any “stinking, fulsome smell comes. Galen, Avicenna, Mercurialis, “new and old physicians, hold that such an air is unwholesome, “and engenders melancholy, plagues, and what not.” After naming several towns abroad, “Salisbury with us, Hull and Lynn” are mentioned; and he goes on to say: “But let the site of places be “as it may, how can they be excused that have a delicious seat, or “pleasant air, and all that nature can afford, and yet, through their “own nastiness, and sluttishness, immund and sordid manner of “life, suffer their air to putrefy and themselves to be choked.” Old Burton was evidently a worshipper of Hygeia.

In the history of Salisbury, Hatcher records no less than five visitations of plague within ninety years. Whether these visits were more frequent here than in other cities over a like number of years I have no means of judging, nor of the exact nature of the disease named plague, but about the actual severity of some of the attacks there can be no doubt. A few particulars may be interesting. The first mentioned was in 1579; no details are given of this, but it appears to have been chiefly in St. Edmund's parish, for to avoid infection by passing along the infected streets to St. Edmund's church, the mayor was that year elected in St. Thomas', and some rent was remitted to the landlord of the George Hotel, belonging to

the corporation, on account of his loss of custom owing to the plague frightening away travellers. In 1604 the plague, after prevailing in London, visited Salisbury; again the election of mayor was ordered away from St. Edmund's. Of this visitation some figures are given, which prove its alarming character:—

	Deaths in 1604.	Deaths in Ordinary Years.
St. Thomas's.....	358	60
„ Edmund's .. .....	501	144
„ Martin's .....	293	72
Total .....	1,152	276

Incidentally we here meet with the average number of deaths for ordinary years—276—which, taking the population at that period to have been about 6,000, gives the high ordinary mortality of 46 in 1,000.

In 1625 great pains were taken by regulations to prevent the plague arriving, as was expected, from London, where it was raging; these means were chiefly the appointment of watchers, to prevent people from London entering the city. No goods from London were allowed to be brought within three miles of the city until three months had elapsed. Persons were appointed as searchers and examiners, and others as buriers of the dead. Oaths were administered to these people, and when they went abroad they were obliged to carry coloured staves in their hands. These regulations were continued in 1626. In November of which year, John Ivie, a goldsmith, was elected mayor; a most remarkable man, whose heroic conduct entitles him to the grateful remembrance of posterity. His conduct suggests a parallel to that of Mompesson, the Derbyshire clergyman, during the plague at Eyam, forty years later. During Ivie's mayoralty the plague broke out with great severity at Salisbury. It commenced in March, 1627, and within four days the city became almost deserted, three-fourths of the citizens having left. The clergy, having in vain endeavoured to keep the populace out of the Close, partook of the reigning panic, and fled; the church service was suspended for nearly a twelvemonth. In a pamphlet published by Ivie, a copy of which is in my possession, I find him writing: "There was none left to assist me and comfort the poor in so great a misery; neither recorder, justice, churchwarden, or overseer in all the city; nor high constable, but only the two petty constables, that had no friend to receive them in the country, wherefore I got them to stay with me, and they did prove to me a great comfort both by night and day." The conduct of this brave man is de-

scribed at length in the "History of Salisbury." He provided storehouses, meted out the supplies raised by the contributions of the surrounding country, put down riots, personally grappled with the ringleaders of the watchmen, when they attacked him armed with bills and staves, demanding increase of wages. Finding the alehouses crowded with the people become desperate in their fear, he even attempted the hazardous expedient of suppressing them; there were then in the city 50 inns and 80 alehouses. The latter he abolished, except one kept by John Chappel, in spite of murmurs and threats. Even this exception tended ultimately to strengthen his authority. "Four weavers, having drunk up all that was in the house, agreed to go to one Mr. Payne's, an ale brewer, and buy one cowl of ale, the price 3s. 4d.; which they did, and brought it to this Chappel's house, and set the cowl upon the table, and another empty cowl by, and made a vow that they would, before they left, drink all that was in one and put their urine in the other, which they did with speed." The result was, that the four weavers, "the master, John Chappel, his wife, and maid, were all dead within three days and a few hours." Another case is related where one Stout, and five more tailors, would, in spite of the mayor's order, "keep a feast, and in a week they were all dead of the plague save one." These anecdotes prove that whatever the particular nature of the plague, it could be brought on by drunkenness and debauchery. From these facts it is clear that an effect similar to that described by Thucydides of the plague at Athens, and by Boccaccio in his "Decameron" of that at Florence, in 1348, was produced at Salisbury, namely, the utter recklessness of despair. The buriers of the dead, and the women who were sworn in as searchers, became callous to their loathsome task, and exulted with fiendish joy over their victims. One anecdote is remarkable. In his pamphlet the mayor writes: "I found the four bearers, each having on their shoulders a thurndel pot of ale, and the woman had on her head a thurndel\* pot of ale. These five were dancing among the graves, singing '*Hie, for more shoulder work,*' in a fearful manner, and when they saw me they ran away."

The deaths from plague upon this occasion, according to a manuscript chronicle of the city, were 369 from March to November. As the population of the city was probably not more than 7,000, three-fourths of whom had left, about one-fourth of the remainder must have died in the whole year 1627. It is worthy of note that a sum of 50*l.* weekly, was, *by order of the magistrates*, levied upon the county for the distressed citizens; also that the city of Bristol volunteered a valuable gift of 84*l.*, sent with a very kind

\* A thurndel, according to Skinner, in his "Etymologicon," was one-third of a gallon.



note, in November, 1627. In 1665, Charles, to escape the plague then raging in London, visited Hampton Court, but thinking that too near, extended his journey to Salisbury, where the court remained during August and part of September, and then went to Oxford, the plague having followed in the royal train. The ravages, however, were then less severe than at the preceding times. No particulars are given of this visitation. In 1666, the city was more severely affected. The mayor was not elected in the city for fear of the plague, but in the Close, by virtue of a licence from the king, dated at Whitehall, 21st September. The burials for the year 1666 were 493.

In history, then, we find it recorded that the plague visited Salisbury five times in ninety years, and we obtain some figures as to the ordinary mortality for a portion of that period—about 46 in 1,000. In 1775, a census made by order of the corporation, gives a total of 6,856 inhabitants, and the deaths for seven years 30 in 1,000 per annum. It is evident that in ancient times, from the various facts related, the city of Salisbury must have been unhealthy, and in recent times, beyond dispute, that character remained applicable to it; for since the Registrar's reports have done away with all conjecture, and placed plain facts before the public, it will be found that a high rate of mortality prevailed in Salisbury, when compared with London, or the rest of the kingdom; for example, it was about 27 in 1,000, that of London being not quite 24, and of all England about 22.

There was one disease very fatal at Salisbury—consumption—as some figures will presently show, and a most frequent disorder in the city was diarrhoea. The causes may have been various, but I am inclined to think that humidity and nastiness of atmosphere produced by the canals and cesspools, and the badness of the water used for domestic purposes, were mainly the causes. I place particular stress upon the badness of the water, for the impurities therein must have entered the systems, not of water-drinkers only, but of all people, in a culinary way, and even in the beer. This beer was, in some instances, brewed with water from the dirty canals, but that obtained from the wells must have been equally bad, contaminated as it was with cesspool filth. I am not aware of any process in brewing calculated to get rid of impurities therein contained. Whatever the cause, this was evident, the very common prevalence of diarrhoea amongst residents in Salisbury, especially in some houses where the well water was very bad.

The contrary effects of good and bad water were illustrated about four years ago, in the city workhouse. This house, previously supplied from wells on the premises, when waterworks were introduced, was supplied from them. A meter being out of order, whilst it was under repair, the old wells were resorted to; diarrhoea set in throughout the house; of 100 inmates, scarcely

one escaped a severe attack ;—the waterworks water being resumed, diarrhœa disappeared. I am aware that this is nothing strange, but the extent of the experiment, as it may be called, proving positively the opposite effects of good and bad water, is worth recording.

It is not for me to go into the question of what part water plays in the animal economy—whether, as Pereira, Rumford, and others believed, being decomposed, it becomes a nutritive agent by assisting in the formation of the solids. However the fact may be, it is very certain that bad water and bad health are very frequently connected.

In 1849, as is well known, during the plague of cholera, Salisbury suffered nearly as much as any city in England. From that disease nearly 200 died within two months ; these deaths occurred amongst people of all classes and of all ages, although doubtless the poor, resident in confined and dirty cottages, suffered most severely. As we have before seen that the clergy fled from a plague in time past, with such conduct it is right to contrast that of the modern members of that profession in this city, of whom none were more assiduous in kind attention to the poor, visiting them at their own houses, than the late Bishop Denison. The total mortality for the year 1849 was 455, so that in that year almost a double average mortality occurred. In 1850, the mortality, as usual after a fatal epidemic, was small, only 158 persons died. Does not this show that many people who succumb to an epidemic, are those in whom, although no active disease had previously manifested itself, yet some morbid seeds must have existed, which, absent the epidemic, would have added their names to the mortuary list of the ensuing year? Besides such cases, I am aware that several known invalids died off by the cholera.

3. *Reasons why, and manner how, the Public Health Act was applied.*—In the year 1850 the directors of the highways who had, under a local act, the management of the city, made a show of consulting the resident medical men as to the best mode of proceeding as regarded sanitary measures, especially in reference to the late severe attack of cholera,—I say, made a show of consulting—because I learned before the day of the appointed meeting, from a member of the board, that whatever opinions in favour of deep drainage might be given, no notice thereof would be taken in practice by the directors, who had determined not to adopt them ; finding this, instead of attending, I sent a letter, in which deep drainage was recommended as one great thing needed : this letter I subsequently printed, and founded upon it proceedings for introducing the Public Health Act. It being soon seen that the directors turned their attention merely (1) to the opening of a few channels which had been covered over in some streets, and (2) to constructing some barrel drains of brick in the upper parts of the



city where no channels existed; also that they publicly held, in the face of several medical opinions, that no better system could be introduced than the old one, in which belief it is but justice to them to state that they were supported by the city medical officer, who in a pamphlet on "Vital Statistics," p. 10, wrote, "Neither nature nor art could have possibly formed channels better adapted for effectually carrying away the sewage of the city than those which already exist." These things being seen, after in vain soliciting others of older standing in the city than myself to take the initiative, I could no longer conscientiously refrain from calling the attention of the General Board of Health to the deplorable state of the city as to sanitary arrangements, feeling the more justified in pursuing this course, because it was no sudden impression derived from the cholera upon which I formed my opinion as to the faulty state of the sewerage in Salisbury, that opinion was then of some years' growth. Upon coming to Wiltshire, I had expected to have seen three remarkable sights—(1) Stonehenge; (2) Salisbury spire; and (3) Salisbury canals, which made that city an English Venice; of which canals the compilers of geographies and gazetteers delighted to write, "This city is abundantly supplied with water from the Avon, which runs in clear rivulets through many of the streets." Stonehenge and the cathedral did not disappoint me, but English Venice did, as regarded its boasted canals, for after a very short residence, I felt impelled to call them nothing but "filthy ditches," which in truth they were. Many writers looked upon them with complacence, and the citizens viewed them as possessing some mysteriously beneficial influence; but I was not alone in my condemnation, for some writers condemned them in strong terms, and a writer in the "Topographer," at the end of the last century, I believe Dr. Stebbing Shaw, used words as little complimentary as mine; he wrote, "Were I an inhabitant of the present town, I think I should be inclined to return to the old forsaken hill to avoid the rivulets (not to say ditches) which do not only disfigure the city, but make it very dirty by day, and are frequently very offensive by night."—"Topographer," vol. iv., p. 233. Holding these opinions, I applied to Dr. Southwood Smith, then one of the General Board of Health, a gentleman who must always be remembered as a most eminent philanthropist and earnest advocate of hygienic measures. The details of how anxiously Dr. Smith furthered my views in connection with Salisbury, would be too long; sufficient here to say, that to a petition for inspection could not be obtained the requisite legal number of signatures—only one-tenth of the ratepayers—although the cholera had just before been raging. The late bishop, the present dean, the late Dr. Fowler, and many of the principal inhabitants signed it, yet a total of only about sixty names was put to it, whilst the enemy

obtained many hundreds of signatures to a counter petition, wherein it was declared, "We consider that the works recently in progress by order of the directors, if fully carried out, to be the best mode of drainage which the low and flat situation of Salisbury admit of." It was confidently predicted that an enormous cost would be incurred, requiring a rate of at least 5s. in the pound: that any works done would be a failure; and, in short, that the city would be ruined. The petition having failed as to the required numbers, by my representations the General Board were induced to use the clause of their Act empowering them to send an inspector to any place where an excessive mortality (above 23 in 1,000) prevailed. I believe this power had rarely, if ever, been before used. Upon the report of an inspector, the Public Health Act was applied. It is much to be regretted that this compulsory clause, although retained in the Local Government Act, 1858, is practically inoperative, because the power therein is given to the General Board of Health, a body no longer existing. It will be interesting to mention some circumstances which may encourage future sanitary reformers to persevere if like difficulties unfortunately should arrest their progress. Under the Public Health Act, in corporate towns, the councillors become the local board; when the inspector reported upon Salisbury, five only out of twenty-four could be reckoned upon as friends to the Act. Of course, without a majority in its favour, the Act when applied was practically useless. To get a majority was no light task. A war—fortunately kept clear of politics from the first, for all shades of opinion were to be found in the petition to the General Board—was waged violently as between new parties formed *for* and *against* drainage. This war was so successfully carried on by the former, that at the end of the *second* year a majority of the board decided upon action. I may, with truth, claim to have been, during the period of contest, the best abused man in Salisbury. In one of the pamphlets which it became necessary to publish, I find myself thus retorting:—"I assure you that no calumny or abuse, public or private, printed or spoken, will ever be able to divert my onward course until a properly directed and extensive plan has been adopted to do what can be done to remedy the evils complained of by me." The city was inspected in 1851, in 1853 works were commenced.

4. *Works for Drainage and Water Supply*.—Before describing these works, it will be well to give a few details of the old modes of sewerage and water supply. A systematic inspection showed that, in addition to numerous privy vaults, many of enormous size—rarely, if ever emptied—there existed hundreds of cesspools, partly into which, and partly into the canals, the sewage was conveyed by means of brick drains. From the first and second were produced the bad effects usual in all towns destitute of proper

drainage, but by the third, namely, the canals, an abomination quite peculiar to Salisbury was created. The canals being near the surface of the streets, and on one side only, the brick drains, in order to enter them, were necessarily very nearly level, and when the canals had water flowing in them, the mouths of the house-drains were submerged, so that in many instances water ran into them from the canals, and in all cases their contents could not escape. Filth was thus pent up, and the stench thereof was thrown back into the premises,—for in most cases the drains were badly or not at all trapped at their origins. All this time, when the water was flowing, nothing very unsightly appeared in the streets, and by day most people viewed the canals as *clear running streams*; but at night, a very different state of things existed. In order to give the house-drains a chance of partially emptying their contents, the water was turned off from the canals, and then the stench was unmistakeable, and the sight presented in a morning before the water was again turned on was disgusting,—luckily for the writers who celebrated the English Venice, it was seen by few,—indeed the canals were then *filthy ditches*. Moreover the current of water when running was never strong enough to cleanse the canals, whence another nuisance peculiar to Salisbury arose. Periodically men with scoops lifted the accumulated filth from the canals, and this was placed in heaps under the eyes and noses of passengers, many tons within a short distance, where it lay for hours or even days before it was carted away. The composition of this filth needed no analysis; it has already been said that numerous water-closets were connected with the canals. Sir John Harington, the inventor of those cleanly comforts, would never have suggested his “Metamorphosis of Ajax” (a jakes), if he could have foreseen such a perverse abuse of his invention as that of obtruding under the sight and smell in public streets those matters which were intended to be hermetically sealed from the senses. It may be mentioned, that Sir John was banished from Queen Elizabeth’s Court, for writing the witty pamphlet alluded to, in which he recommended his invention to the notice of the Queen. Sir John first brought his cleanly comfort of the water-closet into use at his residence of Kelston, near Bath.

*Water Supply.*—This was partly from wells and partly from the canals. The wells were shallow—6 or 7 feet deep—and the water therein was liable to contamination from the soakage of cesspools. In hundreds of instances these cesspools were but a few feet from the wells, and as they received not only the sewage and contents of water-closets, but also rain-water from the roofs and yards, after heavy rains the neighbouring wells were influenced to such a degree that the water was both coloured and stinking: indeed, in several cases, upon going round with the inspector, we found people so ignorant of good water, that from custom they had



been led to the belief of the water of their wells being excellent, even when upon examination it was found actually discoloured and stinking with cesspool filth. One ludicrous anecdote may be given. Some years ago, upon a well being sunk, the water yielded by it was of such colour and taste as to lead to the mistaken notion of a mineral spring having been discovered,—the truth was, a cesspool had been tapped. Such was the well water of Salisbury in general. Of the canals enough has been said to indicate the kind of water obtainable from them; they were, however, to many hundreds of citizens, at once a fountain and a sewer. One more grievance was chargeable upon the canals. Not being water-tight, much water oozed from them and saturated the subsoil almost to the surface; the foundations of the houses near were wet, and, by capillary attraction, their walls became more or less damp; where cellars were attempted, they became occupied by water. By measurement of the inlets and outlets of the canals, it was calculated that 1,000 gallons a minute less passed away *from*, than entered *into* the canals. The saturation of the subsoil by them was thus a fact demonstrated.

The evils then were, wet subsoil, bad sewerage, bad water. The indications of treatment were, to dry the subsoil and to provide good sewerage and water. The remedial works were of a comprehensive kind, and embraced not only the city and the Close, but extended to Fisherton, a part of the borough over the River Avon.

For drainage and sewerage, the works consist partly of brick mains and partly of circular glazed earthenware pipes. The peninsular position of the city and Close became of the greatest importance in securing good drainage. It has been already seen, in their protest, that the opponents asserted the place to be too flat for anything different from the old mode. This assertion about flatness was made by them, not only against facts plain to the most common observation, namely, the existence of a mill with a fall of 6 or more feet, and below that mill a very rapid run of the River Avon for more than a mile round the city to some hatches at which a further fall of several feet occurs, but it was made in direct opposition to the statement furnished by a competent surveyor after careful levelling, wherein was clearly shown a fall of 15 feet existing between points of the river above and below the town, not more than 1,600 yards apart in a direct line. With the lowest level a communication was made by means of a brick main, oval in shape, 4 feet 6 inches in height, and 3 feet wide; the bottom of this at its outlet is 1 foot above the lowest summer level, 1 foot below an ordinary level of the river, and its top is rarely, if ever, covered by the highest flood; this sewer is continued into the town with a gradient of 5 feet to a mile, as far as the White Hart Hotel, where its bottom is nearly 9 feet below the roadway.

As this sewer is built upon the layer of gravel before mentioned, a rapid run of water always exists therein, an artificial brook being formed. From this point two branch brick sewers are continued, rather less, being 3 feet 6 inches high, and 2 feet 4 inches wide, one along New-street and High-street to Fisherton Bridge, and the other along Catherine-street across the Market-square, and up Endless-street; the gradient of these is 8 feet 3 inches in a mile. Into these brick mains circular earthenware tubes, of sizes varying from 15 to 9 inches diameter, convey the sewage from the various streets; these circular pipes are carefully cemented, and at their sides are drain tiles, arranged to carry off the subsoil water. The ruling gradient of these pipes is 22 feet in a mile, a fall sufficient to keep them clear by the action of ordinary house-water. As the house-drains into the canals were found badly made with bricks uncemented, and at wrong levels, they were condemned, and earthenware pipes of 6 inches and 4 inches diameter substituted, at proper inclinations.

The sewage of Fisherton is conducted into the main at Fisherton Bridge, by means of an iron tube 2 feet diameter, placed under the River Avon. In various parts, flushing wells are placed at the corners of the streets, by means of which the pipes are flushed from the hydrants when needed. Ventilation is secured by many of the rain-water pipes being connected with the house-drains.

A great effort was made to retain the canals as clear running streams, when the sewage was diverted therefrom, even by some of those persons favouring the Act, and the inspector was led to view them as ornamental; but as it was admitted that they must be made water-tight, and this involved a great outlay—moreover, it being further pointed out that whilst they existed on one side of the streets only, to carry off storm-water, the streets necessarily sloped towards that side, often becoming concave in the middle instead of convex—their obliteration was at last decided upon, and now having been accomplished, I must plead guilty to the destruction of the city as English Venice.\* The streets have since been made of a proper shape, and storm-waters run off much more rapidly and completely than by the canals.

*Waterworks.*—These works are situated at the north side of the city, and consist of a very neat-looking engine-house, containing a pair of double cylinder or Woolf's engines, of about 25 horsepower each, which are connected to the pumps in a well within the same building. The well is 68 feet deep; at its bottom is a tunnel excavated in the chalk, 70 feet long, in an eastern direction, which serves to increase the gathering surface of the well, and the body of water to pump from. The depth of water in the well is

\* One named the New Canal still remains—it is covered over, and at a much lower level than the others; but its obliteration, I hope, will ultimately be effected.



usually 18 feet, not often reduced to less than 9 feet by the daily pumping. The water is raised from the well to a covered brick reservoir on Bishop Down Hill, a height of 146 feet. This reservoir will hold 260,000 gallons, and is placed high enough for all the houses in the city to be supplied from it. The water is distributed to the houses in iron pipes at high pressure, and this pressure is so great, that copious streams of water may be thrown from the hydrants, placed at 70 yards interval over the whole of the public streets, to a great height in nearly every part of the borough; on many occasions this has been proved in the extinction of fires, indeed, it is found to render fire-engines useless. The water supply is constant during greater part of the 24 hours, and if people would be careful, and have their taps in good order, it might be quite constant night and day. The quantity raised is upwards of 500,000 gallons daily, an enormous supply for the population, which for the whole borough is little over 12,000, thus giving over 40 gallons as the average daily supply for each inhabitant, a quantity nearly double that of many other towns.

*The Cost for the whole Borough* was, of drainage, about 13,000*l.*, of waterworks 14,000*l.*, total 27,000*l.*; which sum was borrowed on the improvement rate system, to be repaid—principal and interest—in thirty years. The special rate for this purpose varies from 1*s.* 2*d.* to 1*s.* 4*d.* in the pound per annum. It will be remembered that the enemy prophesied the probable cost of inefficient works would be at least 5*s.* in the pound. This is the cost of public works contributed by all ratepayers (the rate named “general district rate” is mainly in place of the old “way rate,” and does not quite equal the old rate): for supply of water there is an additional charge of 6*d.* in the pound, a mere trifle, for the advantages secured in good water, and saving of pumping and labour. It may here be specially noted, that hitherto the Local Board of Salisbury have sold, or rather almost given away, water for commercial purposes at only 6*d.* and 8*d.* for 1,000 gallons; the serious injustice thus done to the body of ratepayers is glaring, when it is seen that 1*s.* 6*d.* and 2*s.* per 1,000 for like quantities is charged in several towns, even where the water is obtained by descent from hill reservoirs, and not by means of expensive pumping machinery, as at Salisbury. If the authorities were to charge a fair price for all the water sold for commercial purposes, very shortly the sixpenny supply rate would be reduced by one-half, and ultimately become nearly, if not quite, annihilated.

*The Quality of the Water* from the well is excellent, it is very clear, colourless, of pleasant flavour, and may be called soft, when compared with other well water, or even with river water. Two analyses of this water, made at an interval of two years, give respectively 12 grains and 8 grains of carbonate of lime, and a quarter of a grain and 2 grains of sulphate of lime to a gallon.

This hardness of 10 or 12 degrees is very small, for that of eight old Salisbury wells, given in Mr. Rammel's report, from the analysis of Dr. Lyon Playfair, varied from  $17\frac{1}{2}$  to 45 degrees ; and of 264 wells and springs, according to a report of the General Board of Health, the average hardness was 25.86. The water of the Salisbury well is not half as hard as that of the average of wells, and much softer than that of rivers, *e.g.*, of the Avon, which is  $18\frac{1}{2}$  degrees. There is no organic matter mentioned in the analysis, and no animalculæ are discoverable upon repeated examinations under a powerful microscope.

The works for drainage and water supply were planned by Mr. Rammel, C.E., who had inspected and reported upon the city, and carried out by Messrs. Parnell, of Rugby, under the superintendence of Mr. Bothams, C.E., the present city surveyor.

When the canals were destroyed, and the roads re-constructed, most of the footways were paved with Caithness stone, at a cost of 3,000*l.*, to be repaid—principal and interest—in thirty years ; this well illustrates the superiority of the modern mode over the old one of borrowing money for the same purpose. Forty years ago the pavement was done and paid for by bonds at 4 and 5 per cent. ; that pavement is worn out, but the bonds are not—for ever requiring a 3*d.* rate for interest ; whereas by the new mode, the pavement will probably wear after the debt is cancelled.

5. *Present Condition of the City.*—First, as to changes evident to the senses. Instead of dirty canals with dirty streets sloping towards them, the streets are now rounded in the centres and clean,—the foot pavement equal to that of any town in England, instead of being uneven and full of holes,—neither the eye by day, nor the nose by night, is now offended, as of old ; the whole atmosphere is changed—dry instead of moist ; sweet, instead of stinking ; drainage and good sewerage, and very dry subsoil, in place of a saturated subsoil and bad sewerage ; plentiful supply of good water, available without labour, in place of a bad supply of bad water, with labour of pumping, or of carrying from the channels. Dry underground cellars can now be made. It may be remarked that the opponents of drainage, on account of its supposed impracticableness, were non-plused at an early stage of the operations ; for when the main sewer had advanced only a short distance into the city, quickly, one after another, many wells became dry in the Close and New Street, some hundreds of yards from the drain. This *experimentum crucis* staggered the enemy, and a builder became such a convert that, in New Street, where he was about erecting some houses, he made cellars of considerable depth, which, for more than nine years, have continued quite dry, New Street is in the flat part of the city. Many other cellars have been made in various parts ; the cellar floors are several feet below the old water level in the subsoil. It may be stated, that the subsoil water has been lowered, on an

average, 4 or 5 feet over the city. So much dry ground additional having been gained—*perfectly dry* since the canals have been destroyed. My own cellar is a good example of the perfectness of the change; it is in the Close, between the Cathedral and Avon, a few feet below the natural level of the ground, and in winter always had in it water from a few inches to more than 3 feet deep. Since drainage, the floor has been constantly dry. Nowhere is the beneficial change more evident than in the cathedral, where the subsoil water was used to lie close to, and sometimes actually rise above the floor; since drainage no such thing has occurred, and the whole atmosphere within the building is improved.

These changes are facts evident to the senses of all observers, and, irrespectively of any improvements in sanitary matters, I venture to state, that such changes in this city are well worth all the money expended, on the grounds of cleanliness, comfort, decency, saving of labour, and security against fire. But improvements have occurred in sanitary matters, and to these I propose to call the most serious attention of all sanitary reformers, and that term, I trust, will soon become synonymous with all thinking people.

Since drainage, in nine years, the population being of much the same average, 531 less people have died than in nine years before drainage, *excluding* the cholera year; that is, instead of 4 only 3. I do not propose to enter minutely into the causes of death assigned, and for various reasons, one of which is the uncertainty of any very accurate deductions therefrom; for, in many instances, different medical men would put different names as the cause of death in similar cases. Moreover, there is by far too much of fashion, ever changeable, in medical nomenclature, many similar diseases being called by different names in succeeding generations; but deaths are facts, and to their numbers I will chiefly confine my remarks. I will first show a comparison of *births* and *deaths* over two series of nine years before and after drainage, excluding the cholera of the year 1849:—

	Before Drainage.	After Drainage.
<i>Nine Years—</i>		
Births .....	2,470	2,624
Deaths .....	2,226	1,695
Majority of Births...	244	929

The following table will show the total numbers of deaths in each of nine consecutive years before and after drainage, the years



end upon the 30th *June*, so that the cholera cases of 1849 are excluded :—

Year.	Deaths before Drainage.	Year.	Deaths since Drainage.	Yearly Decrease.
1841.....	230	1856.....	182	48
'42.....	268	'57.....	194	74
'43.....	284	'58.....	213	71
'44.....	251	'59.....	200	51
'45.....	216	'60.....	201	15
1846.....	200	1861.....	132	68
'47.....	321	'62.....	230	91
'48.....	220	'63.....	192	28
'49.....	236	'64.....	151	85
Total.....	2,226	Total.....	1,695	531

The average annual mortality before drainage was about 27 in 1,000 ; for the nine years since drainage, 20 in 1,000. In excluding the cholera cases from this table, many persons, who believe that disease to have been peculiarly the result of removable causes, will think it extenuating the mortality before drainage ; but as the inclusion of those cases would to others appear as a wish to aggravate the case, I have thought it better to treat the cholera as exceptional, and to deal in my comparison only with the ordinary mortality, in which the contrast before and after drainage is quite sufficiently remarkable.

It will be seen from this table that the highest rate of mortality since drainage is but two-thirds of the highest rate before, and itself below the old average. But *when* did that highest rate occur ? In a year when epidemics were rife in the district, scarlatina, measles, and hooping cough were very fatal in the Wiltshire villages, and co-existed in Salisbury, yet its mortality did not reach even to its old average. It will further be observed, that the lowest rate of mortality, 132, is below the lowest rate of any year before drainage, by more than one-third ; and, when compared with the whole kingdom, is astonishing, namely, only 14 in 1,000, against an average for towns of 25, and for the kingdom of 22. It must be remarked that Salisbury city district consists of a population purely *urban*, whilst most country town registration districts include more or less suburban or rural portions. Furthermore, and the fact ought to be particularly noted, Salisbury in its population greatly lacks that element of wealthy residents so plentifully possessed by Bath, Cheltenham, Brighton, &c. Also, Salisbury having numerous small charities for the poor, this class is induced to linger about in expectation of them, and numerous *old* people are attracted to the city by them, who otherwise would have gone

and remained elsewhere. Again, Salisbury not being a manufacturing town, numerous people emigrate therefrom in search of employment at the most healthy periods of life. Thus Salisbury is deficient in the wealthy\* class, and abounds in the *elder* poor class, and in *young* children at the most precarious ages. Therefore, comparing like things with like, the ease, as shown by the previous figures, is much more in favour of the salubrity of Salisbury than even at first sight appears. It would be unfair to require comparison with the towns before named, and with the Belgravian and other fashionable quarters of London; but such comparison can be ventured upon, and for several years past Salisbury will come out the victor.

Although it is not my intention to enter into details as to the assigned causes of all the deaths, I will give a few particulars regarding some.

Zymotic diseases killed 247 people in seven years, before drainage, or 3·88 in 1,000 per annum, *cholera cases being excluded*; in seven years, since drainage, zymotic diseases killed only 172, or 2·73 in 1,000, as an annual average. The zymotic deaths in the whole kingdom being at the rate of 4·45 in 1,000 per annum, a comparison therewith is very much in favour of Salisbury. Whilst 1 in 219 annually dies elsewhere, only 1 in 367 dies from that class of diseases in Salisbury.

Of these zymotic diseases, typhus fever, which commits such ravages throughout the kingdom, can scarcely be said to have occurred as a cause of death in Salisbury, in several years not at all. In the year 1862, out of 623 registration districts in England and Wales, only six were quite free from typhus; and of these Salisbury was the only city, the others were small country districts. In seven years since drainage, 1857-63, only 12 cases of fatal non-eruptive fever have been registered, including typhus, typhoid, and infantile; in seven years before drainage, 1844-50, of those diseases 54 fatal cases occurred. As an annual average for all England, 1 in 1,071 of population dies from typhus and typhoid fevers; in Salisbury only 1 in 5,262. Of diarrhœa, in the last seven years, only 12 fatal cases have occurred, and of these 10 were children of and under 6 months old. In the seven years diphtheria is mentioned only four times by itself, and twice in conjunction with other causes of death. Dentition produced 31 deaths in place of 62 in the former set of seven years. Since drainage a great change has taken place in the number of deaths from the allied tubercular diseases, phthisis, tabes mesenterica, and hydrocephalus, as the annexed table will show:—

\* In this allusion to the *wealthy* class, let me not be misunderstood to mean that such class is longer lived *on account of wealth*; but inasmuch as wealthy people occupy larger houses and better ventilated than poor people do, on that account they have the advantage in sanitary estimates.



	Phthisis.	Tabes Mesenterica.	Hydrocephalus.
Before Drainage, 1844-50...	286	32	30
Since       ,,       '57-63...	143	17	10
Diminution .....	143	15	20

This diminution in a class of diseases admitted to be intimately connected with dirty and moist atmosphere, is remarkable. For comparison, a few facts as to the past and present general statistics of that scourge of England, consumption, may be interesting. In the beginning of this century, one-fourth of the whole number of deaths was put down to it. Inglis, in his book on the Channel Islands, as lately as thirty years ago, makes the following remarks: "Of deaths from all causes, there die of phthisis, in London 25 per cent.; in France, 23 per cent.; at St. Petersburg, 17 per cent.; at New York, 17 per cent.; in Switzerland, Austria, Prussia, and Belgium, the mortality is not materially different from that in England, *i.e.*, 25 per cent., which seems to be its "maximum mortality." Although, doubtless, obtained from the best available sources, these figures cannot be so accurate for England as those since obtainable from the Registrar-General's reports. One of those reports, quoted in the "Penny Cyclopædia" in 1840, placed the proportion of phthisical at 19.55 per cent., or one-fifth of the whole number of deaths. This proportion during the last twenty years has much altered for the better; according to the Registrar's reports for some years past, about one-eighth instead of one-fifth of all the deaths are put down to phthisis. Some of this change may be owing to alteration of nomenclature, and nicer discrimination in diagnosis. At Salisbury, for the last *seven* years, about one-tenth of the deaths have been from phthisis; for the last three years, only one-thirteenth; and for the year 1863, only 11 deaths occurred from phthisis, or 1 in 818 of population, the proportion for London having been 1 in 363, and for all England 1 in 374. The average age at which the 143 deaths from phthisis occurred during the last seven years, was 34.8 years. The comparative number of deaths of children in Salisbury will be seen in the following table:—

DEATHS OF CHILDREN IN PROPORTION TO THE WHOLE MORTALITY.

	In 1,000 Deaths.	
	Under 1 Year.	Under 5 Years.
All England .....	232	408
Lancashire .....	252	473
London .....	207	424
Salisbury { before drainage .....	161	354
{ since       ,,       .....	193	337

The actual numbers of deaths of children appear in the next table :—

	Seven Years before Drainage, 1838-44.		Seven Years since Drainage, 1857-63.
Under 1 year .....	280	Under 1 year .....	253
„ 2 years .....	131	„ 2 years .....	91
„ 3 years .....	95	„ 3 „ .....	62
„ 4 years .....	44	„ 4 „ .....	30
„ 5 years .....	36	„ 5 „ .....	22
Total under 5 years...	586	Total under 5 years...	458

It will be seen from these tables that, although the actual number of children's deaths is decreased since drainage, the decrease is not so great in ratio as of the whole mortality, or of some particular diseases as before described, whilst the *proportion* of deaths under 1 year old to the whole number is greater. This fully bears out what I have always imagined, that the deaths of very young children will be numerous in spite of public sanitary reform; the true remedy must be looked for in parental management, the improvement of which, I venture to suggest, will be brought about by education, and that domestic more than scholastic.

*The Close of Salisbury*, with a population not varying much over a long series of years, presents the following facts as to mortality. For many years, as shown in Mr. Rammel's report, that mortality was at the rate of nearly 20 in 1,000; for the last *nine* years, since drainage, it has been only about 14 in 1,000, thus showing a death-rate lower than that of the Isle of Wight, which is 17; of Cumberland, Westmoreland, and other rural districts, the most healthy in the kingdom; for the death rate of seventy of the districts, selected as the most healthy in England, is 17 in 1,000. Only a portion of Fisherton parish being in the borough, figures as to its mortality would be with difficulty obtained, and inferences therefrom would be quite valueless for various reasons. Since the railways have concentrated there, for a few years past, its population has suddenly increased so much that comparisons with former periods would be impossible. For instance, that population in 1851 was 1,905, in 1861, 2,424. Moreover, there are in Fisherton a large lunatic asylum, containing nearly 500 inmates from all parts of the kingdom, also the county gaol and general hospital; all these circumstances make any useful sanitary deductions as to Fisherton out of the question. Such deductions would be as valueless as those given from time to time from the various watering-places, which appear to me worse than useless, for they produce only confusion in the minds of readers, and tend to divert

attention from true statistics of other places, the true being liable to become mixed up with the merely conjectural; thus a serious damage may result to the cause of sanitary reform.

There is yet one other benefit directly traceable to the drainage in Salisbury—the formation of a museum—which happened in this way. In the excavations for the sewers numerous articles were found; ancient cutlery, spoons, arrow heads, pilgrims' signs, tradesmen's tokens, rings, &c. These were found chiefly in the middle of the streets, evidently in the beds of the old rivulets. They were collected by a gentleman who since left the city, and, at his sale, were bought by myself and a few others, to form the nucleus of a local museum. A letter was put by me in the "Journal," asking, "Why shall Salisbury not have a Museum?" The late Dr. Fowler, then 95 years old (I believe one of the first members of the British Association), immediately called upon me, and offered to co-operate; and ultimately he and Mrs. Fowler furnished the chief part of the funds to purchase and adapt a building for the purpose. This has been done, and a very considerable museum already exists.

I have now given what I undertook, a statement—I trust an intelligible one—of the alterations at Salisbury, done under the Public Health Act. In doing so, I have endeavoured to be liberal in facts, sparing in opinions. The great fact of 531 deaths, that is, nearly one-fourth of the whole number, having occurred over one period of nine years less than over another like consecutive period of years, naturally suggests the question, Did anything unusual happen between these periods? The answer has just been given. The next question is, Did the thing done *cause* the difference of mortality? In answering this question, I particularly wish to guard against dogmatically asserting the *post hoc* to have been wholly *propter hoc*. I do not claim that drainage and water-works saved all the 531 lives, being quite aware that so many concomitant physical and moral causes exist to produce effects upon vitality—so many ways to the gates of death—that to make such claim would be as rash as to put the hand upon each of 531 persons and say, you and you were saved. But, holding the strong opinions which I do about the fostering causes of many diseases being removable, and seeing what I do see in Salisbury, it would be affectation on my part not to say that I believe the works done to have been one cause, and that the main cause, of the diminution of mortality; and although it may be objected that assertion is easy, proof difficult, in vital statistics; in this case, I do not think it would be easy, if possible, to suggest another even plausible cause of such a great alteration having continued for so many as nine years. The diminution of consumption certainly appears to be a demonstrated effect from an evident cause.

I look upon many of the figures derivable from Salisbury as

peculiarly valuable in statistics, because the population is *urban* only, and varied little in numbers over a long period of years; also, because the bulk of it is stationary over the various months of the year.

6. *It remains for me to make a few General Remarks.*—My first is, to caution people against expecting too much from sanitary reform. I have heard it said during the present summer, “We shall have no cholera now, owing to the drainage.” This is being more sanguine than I have ever been; for, even if sanitary arrangements *could* entirely prevent it, that they ever will be so complete as to do so, I fear it is quite utopian to expect. My belief about cholera and other epidemics is, that their primary causes are atmospheric, and quite independent of human influences; that they may be ubiquitous, and, when not so, do prevail over a large extent of country at one time, or pass in determinate currents in quick succession. Whether such primary causes consist of a variable state of caloric, of electricity, or quantity of ozone, or other agent never yet thought of, as seeds of disease they become everywhere sown, and yield fruit where they find fostering circumstances favourable to their development; that such fostering causes in the case of cholera were proved to exist in dirty, badly-drained towns, and eminently in the most confined and dirty parts; and further, I believe that in so far as these circumstances are removable, and are removed, the chance of cholera attacking, or if attacking, of killing, human beings, is lessened. When it shall have been discovered exactly what special causes determine whether an epidemic shall be in form of influenza, scarlatina, or cholera, the question of the entire prevention of their future occurrence may be discussed; but at present conjecture as to them only exists, and I fear, should the causes ever become known, they will be found to be produced upon such a grand scale, that operations of the human laboratory will never be comprehensive enough to prevent such production being carried on in the laboratory of the atmosphere. Practically, then, we must be content to prevent, as much as possible, their deadly effects, by the removal of those fostering conditions which observation proves to be friendly, if not necessary, to their fatal development. For that purpose, I believe all known sanitary measures, cleanliness, ventilation, drainage, and good water supply, ought to be everywhere adopted.

There is another subject upon which I think many people have unreasonable expectations from sanitary reform, that is, the point to which the average annual mortality can be reduced. In one of the pamphlets printed during the drainage contest, I held out a prospect that, in case of drainage and waterworks being adopted, the mortality of Salisbury, instead of 27 in 1,000, would probably be one-third less. I am happy to find that such hope has been realized, for the average of five out of the nine years since drainage,



the mortality has been exactly one-third less, or 18 per annum in 1,000; but when I see 10 in 1,000 mentioned by some writers as an attainable minimum, I own not being sanguine enough to look for such a low figure in large populations over periods of years. Such a calculation is arrived at by excluding deaths from zymotic diseases, as in *all cases preventible*, which in practice is a perfection scarcely to be expected. Moreover, mental and other causes of disease appear to increase as civilization advances, and will in no small ratio counteract the good done by sanitary reformers, who can deal chiefly with mere physical causes, and with only some of these, for diet and clothing are beyond their control, although possibly lodgings may not always be.

There is a class of persons, including some medical men, who hold that atmospheric stench from cesspools, privies, &c., do not produce disease, but that poverty is the true cause of the diseases alleged by sanitary reformers to be so produced. Now, as poverty and bad air arising from the sources named so often co-exist, this argument possesses a plausibility which requires the most careful collation of facts, in order to refute its dangerous tendency as regards all practical sanitary measures. Allowing poverty, as such, to be one predisposing cause of disease, I believe that it is infinitesimal when compared with bad air and uncleanness, and that these, with bad water, are mainly the producers of that state of body which renders people a prey to epidemics, whatever the primary causes of such epidemics may be. Further, I believe that were these things found as often to co-exist with the rich as with the poor, the rich and poor would be almost equally subject to fatal attacks of epidemics, *e.g.*, of cholera, which equality of attack amongst similar numbers certainly did not occur. Of 100,000 inhabitants of the west of London, and 100,000 in the east thereof in 1849, the former suffered little in comparison with the latter; but this difference was not on account of the poverty of the latter. I believe that if the 100,000 people had changed places, the rich would have suffered nearly if not quite as much in the east, and the poor have escaped in Belgravia as much as the rich did. This view is very far from imaginary, for its accuracy was fully borne out by facts, which happened to my own knowledge in Salisbury as regards cholera. A large proportion of fatal cases occurred amongst well-to-do people: there died one physician and several tradesmen. In localities where the fostering causes most abounded, rich and poor suffered pretty equally, as on the southern side of the Thames in London, and in other places. The Registrar-General's last quarterly report proves with singular force the correctness of this view of poverty, *per se*, not being chargeable with epidemic fatality. The writer remarks, "It is a singular circumstance that the mortality often augments with the increased prosperity of a district;" and he gives a remarkable

illustration from the Ulverston district in Lancashire. The mortality at Dalton in that district, for the last two quarters, was at the rate of 42 and 31 in 1,000 per annum; and the spectacle there presented was, "work plentiful, wages good, provisions "cheap," with the prevalence of "destructive epidemics." He goes on to say, "impure water, impure air, their own exhalations, "kill men, women, and children on the spot, and breed the leaven "which devastates the towns and valleys in the vicinity."

The most determined sceptic about filth producing disease, has never yet gone the length of asserting that cleanliness causes disease, nor of suggesting a suspicion of its doing so. It then follows that, apart from sanitary considerations, as cleanliness is desirable for comfort and decency, it ought to be secured by all possible means. Thus it is a duty incumbent upon all those who do not believe in dirt producing disease, to drain their towns and to provide good water, on account of comfort and decency, whilst upon those who do believe dirt and bad water productive of disease, such duty becomes doubly incumbent.

The pollution of rivers by the sewage of towns is just now a very favourite topic of complaint, and rightly so in many, perhaps in most cases; but there is a danger of legislation upon the subject being made too general and sweeping. That many rivers are polluted injuriously to decency, if not to public health, is undoubtedly true, but that all rivers into which town sewage is conducted either are, or are likely to become, offensive to the public health, or even to that of the fishes which inhabit them, is not true. Where a large town is drained into a small river, as the Rea at Birmingham, or even into a large river, comparatively small with the town, as the Thames at London, a nuisance, doubtless, is created, and ought to be rectified; but where a small town is drained into a tolerably large and rapid river—that river not being a tidal one, especially when the outlet of the drain is at a good distance from the town, as in the Avon at Salisbury—no nuisance, present or prospective, is indicated—the public are in no way annoyed, and as for the fishes\* they flourish exceedingly; for it is a remarkable fact, that enormous trout—the largest in the river—have been taken at and just below the outlet of the main drain; in which drain, as before shown, a considerable flow of subsoil water always exists. Any act of the legislature, then, compelling the diversion of the sewage of Salisbury from the Avon, into which it is now harmlessly flowing, would be a very unnecessary interference, and productive of great inconvenience and cost. Of course, at a

\* Three hundred years ago Palladio wrote about the great common sewer of Rome. "Upon measuring I found it to be 16 feet diameter. Into this all "other sewers of the city do empty themselves, which *is the reason that stur-* "geons taken between the Senatorian and Sublician bridges are better than "others, feeding on the filth coming out of this great sewer."

future day, if any ready way of collecting the sewage and of selling it should be found out, applicable to the locality, such diversion might be desirable as an act of municipal economy. In the meanwhile, the neighbourhood below Salisbury is not only not injured, but enormously benefited, inasmuch as the whole of the Avon water is used to irrigate meadows within a few miles below the city.

In conclusion, as regards the true position occupied by *hygiène*, or sanitary reform, I believe that the mortality and sickness of this country, I may add, of all countries, are excessive in proportion to what they might be, were sanitary measures generally adopted. If only half, or even a smaller part of such excessive disease and death can be prevented, sanitary reformers will have done more good for their fellow beings than the combined efforts of all medical men have achieved merely by means of drugs; for, however admirable it may be to combat and subdue diseases by medicines, there can be no doubt, but that to prevent many cases of disease occurring at all, and to modify others, with all their accompanying miseries, will be of much more benefit to mankind. For if it be desirable to prolong life, which few will deny, it is equally desirable to make life enjoyable by removing many ascertained evils which do not necessarily belong to it. Let me not be misunderstood. In saying this, I have no intention of decrying the immense utility of curative medicine, but of asserting, and fixing attention upon, the vast importance of *hygiène*, *this* dealing with whole communities, *that* administering only to individuals. Besides, the proverb, "Prevention is better than cure," in sustentation of my remarks, I can plead the following from Lord Bacon, in the dedication to "Posteritie" of his "History of Life and Death, or of the Prolongation of Life;"—"For we have Hope and wish that it "may conduce to a common good, and that the nobler sort of "Physicians will advance their thoughts, and not employ their times "wholly in the sordidness of cures; neither bee Honoured for "necessitie only. But that they will become Coadjutours and "Instruments of the Divine Omnipotence and Clemencie, in "prolonging and renewing the Life of Man; especially seeing we "prescribe it to be done by Safe, and Convenient, and Civil ways, "though hitherto unassayed."

There is yet one other class of objectors to sanitary reform, the fatalists; who, if not numerous, are most dangerous, because they work upon men's religious fears by representing cholera and other epidemics as judgments, and by more than insinuating that attempting preventive measures is flying in the face of Providence. To such objectors, I say boldly, that not to attempt the removal of now well-known fostering causes of many epidemics, bad air, bad water, &c., but to stand by and attribute the diseases to fate, would be as heinous a crime in the sight of man or man's Creator, as to

stand by and see a man drowning, without attempting to pull him out of the water. To all such fatalists I would say, "Become "sanitary reformers ; for, in the words of Bacon, you will then be "Coadjutours and Instruments of the Divine Omnipotence and "Clemencie, in prolonging and renewing the Life of Man."

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## A TABLE OF COMPARATIVE MORTALITY.

### *For Ten Years—*

England	...	...	...	...	22 in 1,000 per annum
142 districts including chief cities	...	...	...	...	24 "
London	...	...	...	...	23 "
Liverpool	...	...	...	...	33 "
Manchester	...	...	...	...	31 "
Birmingham	...	...	...	...	27 "
Southampton	...	...	...	...	24 "
Brighton	...	...	...	...	22 "
Scarborough	...	...	...	...	21 "
York	...	...	...	...	24 "
Exeter	...	...	...	...	24 "
Bristol	...	...	...	...	27 "
Clifton	...	...	...	...	21 "
Bath	...	...	...	...	22 "
Worcester	...	...	...	...	23 "
Canterbury	...	...	...	...	23 "

### *For Nine Years—*

City of Salisbury	{ before drainage	...	27 in 1,000 per annum
	{ since	"	20 "
Close of Salisbury	{ before drainage	...	20 "
	{ since	"	14 "

The figures in this table have been taken from places of various kinds and situations ; inland and maritime, cathedral, manufacturing, and pleasure towns ; and with any of them it will be seen that, for nine years' past, Salisbury bears a favourable comparison.



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